

REMARKS

Claims 15-20, 27 and 28 are pending in the present application. Claim 15 is herein amended. No new matter has been entered.

Claim Rejections - 35 U.S.C. § 103

A. Rejection based on Delangle in view of Alberts

Claims 15-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Delangle** (J. Org. Chem, 1996, v. 61, p. 8904-14) in view of **Alberts** (J. Am. Chem. Soc., 1979, v. 101, p. 3545-53). Favorable reconsideration is requested.

Applicants respectfully submit that Delangle in view of Alberts does not teach or suggest a process using the phosphoramidate compound represented by formula (1) of claim 15.

When the R³ of formula 1 in claim 15 unites to form an alkylene group, a cycloalkylene group, or an arylene group, the compound of the present invention becomes a “macrocyclic” compound. However, in cases where it is used for the purpose of extracting a metal ion, the macrocyclic compound having an ethyl crown structure taught in Delangle is entirely different from the alkylene group, cycloalkylene group, or arylene group-mediated macrocyclic compound in the present invention, and the two cannot be said to resemble one another.

Crown ether is a kind of cyclic ether, and is formed from the repeating structure [-CH₂-CH₂-O-]. Out of this, the oxygen atom has a non-covalent electron pair, and it is able to coordinate with metal ions. Crown ether can coordinate with ions with its multiple oxygen atoms and, in particular, it has the property of bonding strongly with an ion that matches the size of the

crown ether's radius. The CH_2 group, which does not participate in bonding to the ion, is lipophilic and the complex compound of the crown ether and the ion becomes entirely lipophilic. Generally, the ion is hydrophilic and insoluble with organic solvents, but since an ion captured by crown ether becomes wholly lipophilic, the crown ether can be used as a phase transfer catalyst to cause the ion, which is usually insoluble in organic solvents, to move from the aqueous phase to an organic solvent phase. The above properties of crown ethers are recorded in the general organic chemistry textbook *Organic Chemistry, 6th Edition* (by Robert T. Morrison, Robert N. Boyd), among others, and is common knowledge in the art.

Also, since the crown ether's ability to capture ions exists through the coordinating ability of the non-covalent electron pairs of its oxygen atoms, it is clear to one with ordinary skill in the art that even if they are similar circular compounds, cycloalkane or cycloaryl, which do not have atoms with a non-covalent electron pair, cannot be substitutes for crown ether.

Delange states that "In table 4, it is shown that the 21-membered ring 4, which bears five binding sites, forms stronger complexes than 3 and 5 and presents a marked selectivity for K^+ and NH_4^+ cations." (Delange, p. 8911, left column, line 33 to right column, line 1.) It is shown that the oxygen atoms function as binding sites for the ion and that the number of oxygen atoms and the size of the radii effect ion preference. Further, table 4 and Fig. 10 in Delange can also be read as saying that, like the Delange compound crown ether, the size of the radius reflects ion preference. From what is written in Delange, one of ordinary skill in the art would understand that when the Delange compound captures an ion, the crown ether structure plays an essential

role. Delangle teaches a compound having a crown ether structure, but there is nothing teaching the ability to form a complex of a compound not having a crown ether structure.

Delangle and Alberts both disclose the use of crown ether structures for trapping ions. However, claim 15 explicitly excludes the use of crown ether structures. Claim 15 recites that if the R³s are united, they “form an alkylene group, a cycloalkylene group or an arylene group.” R³s in claim 15 are explicitly excluded from forming a polyether group which is required for forming a crown ether unit.

The Office Action of July 25, 2008 cites examples corresponding to Examples 33 and 24 in the present specification as being similar to macrocyclic compounds of Delangle. (Office Action, July 25, 2008, p. 3.) However, these examples do not have a crown ether structure as in Delangle and Alberts. In Delangle and Alberts, the crown ether structure provides functionality for trapping ions. In the present invention as recited in the claims, formula (1) explicitly excludes the use of a crown ether structure. Since Delangle and Alberts both disclose the use of crown ether structures, they cannot form a structure corresponding to formula (1) of claim 15.

B. Rejection based on Laskorin in view of Romanovskiy

Claims 15-20 and 27-28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Laskorin** (CAPLUS Abstract of Radiokhimiya (1984), 26(2), 161-6) in view of **Romanovskiy** (US 6,258,333). Favorable reconsideration is requested.

(1) Applicants respectfully submit that Laskorin in view of Romanovskiy does not teach or suggest:

a process for extracting a rare earth metal ion from an aqueous solution containing a rare earth metal ion, comprising using as an extraction agent

the phosphonamide compound represented by general formula [1] ...
wherein said process for extracting a rare earth metal ion does not include
the use of a complex organocarbon compound or a substituted or
unsubstituted polyethylene glycol

as recited in amended claim 15.

Romanovskiy teaches a method for extracting a rare earth metal ion using a solution including a complex organoboron compound, a substituted or unsubstituted polyethylene glycol (PEG), and a neutral phosphoric compound.

However, the invention disclosed in Romanovskiy does not use only a neutral phosphoric compound as a catalyst, but includes a complex organoboron compound and PEG, and there is no indication in Romanovskiy that extraction can be performed with a neutral phosphoric compound alone. In other words, in the method of extracting metal ions in Romanovskiy, there is no awareness whatsoever that a neutral phosphoric compound can be used by itself. That means that the extraction method taught by Romanovskiy has clearly different catalysts than the extraction method of the present invention, which uses only an organic phosphoric compound, without combining it with a complex organoboron compound and PEG.

(2) Applicants respectfully submit that it would not have been obvious to combine the teachings of Laskorin and Romanovskiy.

Laskorin teaches the complex of an organic phosphoric compound and uranium, and suggests the possibility of extracting uranium using an organophosphorus compound. On the other hand, Romanovskiy is related to a method of combining an organophosphorus compound, a complex organoboron compound, and polyethylene glycol (PEG) to extract metal ions. Further, Romanovskiy contains an example (the example where $(\text{OctO})_2\text{Bu}_2\text{CMP}$ is 0 in Table 1) where

the extraction is executed using only a complex organoboron compound and PEG, without using an organophosphorus compound. Even in that example, the extraction of the metal ions was successful. In Romanovskiy, the role of an organophosphorus compound is no more than an adjunct to a complex organoboron compound and PEG in the extraction of metal. On this point, Romanovskiy differs from the method of using an organophosphorus compound as an extraction agent suggested in Laskorin.

Further, regarding the type of organophosphorus compound used, Romanovskiy uses carbamoyl phosphonic acid or carbamoyl phosphine oxide as an organophosphorus compound, but a compound including a carbamoyl group does not exist in Laskorin. In their objectives of extracting metal ions, the compound taught by Laskorin and the compound taught by Romanovskiy are different in the ion-capturing function of portions of their chemical structure.

Laskorin describes an organophosphorus compound and a complex uranium compound, and the method of using an organophosphorus compound as an adjunct in the extraction of metal with a complex organoboron compound and PEG in Romanovskiy are different in the content of their art. Further, the organophosphorus compound used in Laskorin and Romanovskiy differs on the important point related to the complex formation. Therefore, it would not have been obvious to one of ordinary skill in the art to combine the teachings of Laskorin and Romanovskiy.

For at least the foregoing reasons, claims 15-20, 27 and 28 are patentable over the cited references. Accordingly, withdrawal of the rejection of claims 15-20, 27 and 28 is requested.

Application No.: 10/506,424
Art Unit: 1626

Amendment under 37 CFR §1.111
Attorney Docket No.: 082460

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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